Citation:

Parnell TL, Harris LJ, Suslow TV. Reducing *Salmonella* on cantaloupes and honeydew melons using wash practices applicable to post-harvest handling, food service and consumer preparation. *Int J Food Microbiol.* 2005 Mar 1; 99 (1): 59-70.

PubMed ID: 15718029

Study Design:

Non-randomized trial

Class:

C - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

NEUTRAL: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

- To evaluate the efficacy of washing methods on cantaloupe under conditions that would be typically used in the home by consumers or by food service operators
- To evaluate implications of inadequate water disinfection on commercial packing and minimal fresh-processing operations that utilize brush washing as part of the post-harvest.

Inclusion Criteria:

- Cantaloupe and honeydew fruit were collected directly from production fields in the Central Valley of California during peak production periods between August and September
- Ripe melons were available at local grocery stores or produce markets.

Exclusion Criteria:

Visible microbial growth or physical defects.

Description of Study Protocol:

Recruitment

Cantaloupe and honeydew fruit were collected directly from production fields in the Central Valley of California during peak production periods between August and September.

Design

Non-randomized trial.

Blinding Used

None stated.

Intervention

- Melon rinds were spot-inoculated onto a 2.5cm^2 area of rind (squares) with approximately 6.0 log$_{10}$ CFU/square of an avirulent nalidixic acid-resistant strain of *Salmonella typhimurium*
- Melons were washed by immersion in 1,500ml of water or 200ppm total chlorine and allowed to soak or were scrubbed over the entire melon surface with a sterile vegetable brush for 60 seconds
- Inoculated sites, uninoculated sites ("next to" sites) that were adjacent to inoculated sites, and sites on the side of the melon opposite (remote sites) the inoculated site were excised and pummeled in a stomacher for two minutes prior to plating onto tryptic soy or bismuth sulfite agar supplemented with 50 mcg/ml nalidixic acid.

Statistical Analysis

Tukey's post hoc grouping and repeated-measures analyses were performed using PROC GLM and differences were considered significant at $P<0.05$.

Data Collection Summary:

Timing of Measurements

- Samples were diluted in 0.1% peptone and plated on media
- Plates were counted by hand at 24-48 hours after incubation at 37° Celsius.

Dependent Variables

Salmonella typhimurium.

Independent Variables

- Recovery method: Vortex vs. stomach
- Fruit: Melon vs. cantaloupe
- Sanitizing agent: Water vs. chlorine
- Washing method: Soaking vs. scrubbing.

Control Variables

Inoculation area and time washing.

Description of Actual Data Sample:

- *Initial N:*
  - Five samples of honeydew melon
  - Four samples of cantaloupe
  - Different numbers of samples used in different experiments.
- *Attrition (final N):* As above
- *Age:* Not applicable
- *Ethnicity:* Not applicable
- *Other relevant demographics:* None listed

- *Anthropometrics:* None listed
- *Location:* Davis, CA.

Summary of Results:

Key findings:

- *S. typhimurium* was reduced on the rind of cantaloupe by 1.8 log CFU per melon after soaking for 60 seconds in 200ppm total chlorine, which was significantly better than the 0.7 log CFU per melon achieved with soaking in water
- For both water and 200ppm total chlorine, scrubbing with a vegetable brush was shown to be significantly (0.9 log CFU per cantaloupe) more effective than soaking alone. When honeydew melons were soaked or scrubbed in water, reductions of 2.8 log CFU per melon or more than 4.6 log CFU per melon (four of five samples), respectively, were observed
- However, when water treatments were used, the presence of *Salmonella*-positive "next to" and remote sites indicated that bacteria were spread from inoculated site on the rind to uninoculated sites either through the rinse water (40-70 CFU per ml of *Salmonella*) or scrub brush (400-500CFU per brush)
- Transfer to other sites occurred more often with cantaloupe than honeydew melons. This transfer was eliminated when 200ppm total chlorine was used. When 200ppm total chlorine was used, *Salmonella* could not be detected in the water or on the scrub brush.

Author Conclusion:

- In agreement with current recommendations, consumers and food service industries should scrub melons with a clean brush under running water. It is important that these instructions also include advice on cleaning and sanitizing brushes prior to and after preparation, as using a contaminated scrub brush may negate the benefits achieved with washing
- Brushes can be cleaned either by washing in the dishwasher with a hot cycle or by soaking in a 200ppm total chlorine solution made with 45ml household bleach (5% sodium hypochlorite) per liter of water.

Reviewer Comments:

Small number of melon and cantaloupe samples.

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes

3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	???
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	N/A
2.4.	Were the subjects/patients a representative sample of the relevant population?	???
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	N/A
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A

3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	N/A
4.1.	Were follow-up methods described and the same for all groups?	N/A
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	N/A
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	N/A
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	Yes
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	N/A
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A

6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	N/A
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	N/A
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes

10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes